Practitioner's Docket No. 915-003.7

CHAPTER II

Preliminary Classification:
Proposed Class
Subclass
NOTE: *"All applicants are requested to include a preliminary classification on newly filed patent applications. The preliminary classification, preferably class and subclass designations, should be identified in the upper right-hand corner of the letter of transmittal accompanying the application papers, for example 'Proposed Class 2, subclass 129' " M.P.E.P., § 601, 7th ed.*

TRANSMITTAL LETTER TO THE UNITED STATES ELECTED OFFICE (EO/US)

(ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II)

PCT/IB00/01323	5 September 2000	6 September 1999
INTERNATIONAL APPLICATION NO	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED

Method for Quality Measurement in a Mobile Telecommunications System
TITLE OF INVENTION

Hans AHNLUND, Alexander ESSER, Philip WESBY, Teppo TOSSAVAINEN
APPLICANT(S)

BOX PCT
U.S. PATENT AND TRADEMARK OFFICE
P.O. BOX 2327
ARLINGTON, VA 22202
ATTN: EO/US

CERTIFICATION UNDER 37 C.F.R. § 1.10*
(Express Mail label number is mandatory.)
(Express Mail certification is optional.)

I hereby certify that this Transmittal Letter and the papers indicated as being transmitted therewith is being deposited with the United States Postal Service on this date March 6, 2002, in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EV005525742US, addressed to the: Assistant Commissioner for Patents,

Judith Schick
(type or print name of person mailing paper)

Judith Schick
Signature of person mailing paper

WARNING: *Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. § 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.*

***WARNING:** Each paper or fee filed by "Express Mail" **must** have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. § 1.10(b).*
*"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will **not** be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.*

NOTE: To avoid abandonment of the application, the applicant shall furnish to the USPTO, not later than 20 months from the priority date: (1) a copy of the international application, unless it has been previously communicated by the International Bureau or unless it was originally filed in the USPTO; and (2) the basic national fee (see 37 C.F.R. § 1.492(a)). The 30-month time limit may not be extended. 37 C.F.R. § 1.495.

***WARNING:** Where the items are those which can be submitted to complete the entry of the international application into the national phase are subsequent to 30 months from the priority date the application is still considered to be in the international state and if mailing procedures are utilized to obtain a date the express mail procedure of 37 C.F.R. § 1.10 must be used (since international application papers are not covered by an ordinary certificate of mailing—See 37 C.F.R. § 1.8.*

NOTE: Documents and fees must be clearly identified as a submission to enter the national state under 35 U.S.C. § 371 otherwise the submission will be considered as being made under 35 U.S.C. § 111. 37 C.F.R. § 1.494(f).

I. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 U.S.C. § 371:

a. ☒ This express request to immediately begin national examination procedures (35 U.S.C. § 371(f)).

b. ☒ The U.S. National Fee (35 U.S.C. § 371(c)(1)) and other fees (37 C.F.R. § 1.492) as indicated below:

2. Fees

CLAIMS FEE	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
☒*	TOTAL CLAIMS 18	-20=		× $18.00=	$
	INDEPENDENT CLAIMS 3	-3=		× $84.00	
	MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $260.00	
BASIC FEE**	☐ U.S. PTO WAS INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where an International preliminary examination fee as set forth in § 1.482 has been paid on the international application to the U.S. PTO: ☐ and the international preliminary examination report states that the criteria of novelty, inventive step (non-obviousness) and industrial activity, as defined in PCT Article 33(1) to (4) have been satisfied for all the claims presented in the application entering the national stage (37 C.F.R. § 1.492(a)(4)) ..... $100 ☐ and the above requirements are not met (37 C.F.R. § 1.492(a)(1)) ..... $710 ☒ U.S. PTO WAS NOT INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where no international preliminary examination fee as set forth in § 1.482 has been paid to the U.S. PTO, and payment of an international search fee as set forth in § 1.445(a)(2) to the U.S. PTO: ☐ has been paid (37 C.F.R. § 1.492(a)(2)) ..... $740 ☐ has not been paid (37 C.F.R. § 1.492(a)(3)) ..... $1040 ☒ where a search report on the international application has been prepared by the European Patent Office or the Japanese Patent Office (37 C.F.R. § 1.492(a)(5)) $890				890.00
	Total of above Calculations				= 890.00
SMALL ENTITY	Reduction by 1/2 for filing by small entity, if applicable. Affidavit must be filed also. (note 37 C.F.R. § 1.9, 1.27, 1.28)				-
	Subtotal				890.00
	Total National Fee				$ 890.00
	Fee for recording the enclosed assignment document $40.00 (37 C.F.R. § 1.21(h)). (See Item 13 below). See attached "ASSIGNMENT COVER SHEET".				
TOTAL	Total Fees enclosed				$ 890.00

*See attached Preliminary Amendment Reducing the Number of Claims.

i. ☒ A check in the amount of $890.00 to cover the above fees is enclosed.

ii. ☐ Please charge Account No. _____ in the amount of $ _____. A duplicate copy of this sheet is enclosed.

**WARNING: *"To avoid abandonment of the application the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 30 months from the priority date: * * * (2) the basic national fee (see § 1.492(a)). The 30-month time limit may not be extended." 37 C.F.R. § 1.495(b).*

WARNING: *If the translation of the international application and/or the oath or declaration have not been submitted by the applicant within thirty (30) months from the priority date, such requirements may be met within a time period set by the Office. 37 C.F.R. § 1.495(b)(2). The payment of the surcharge set forth in § 1.492(e) is required as a condition for accepting the oath or declaration later than thirty (30) months after the priority date. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than thirty (30) months after the priority date. Failure to comply with these requirements will result in abandonment of the application. The provisions of § 1.136 apply to the period which is set. Notice of Jan. 3, 1993, 1147 O.G. 29 to 40.*

3. ☒ A copy of the International application as filed (35 U.S.C. § 371(c)(2)):

NOTE: *Section 1.495 (b) was amended to require that the basic national fee and a copy of the international application must be filed with the Office by 30 months from the priority date to avoid abandonment. "The International Bureau normally provides the copy of the international application to the Office in accordance with PCT Article 20. At the same time, the International Bureau notifies applicant of the communication to the Office. In accordance with PCT Rule 47.1, that notice shall be accepted by all designated offices as conclusive evidence that the communication has duly taken place. Thus, if the applicant desires to enter the national stage, the applicant normally need only check to be sure the notice from the International Bureau has been received and then pay the basic national fee by 30 months from the priority date." Notice of Jan. 7, 1993, 1147 O.G. 29 to 40, at 35-36. See item 14c below.*

a. ☐ is transmitted herewith.

b. ☐ is not required, as the application was filed with the United States Receiving Office.

c. ☒ has been transmitted

i. ☒ by the International Bureau.
Date of mailing of the application (from form PCT/1B/308): 15 March 2001

ii. ☐ by applicant on _____.
Date

4. ☒ A translation of the International application into the English language (35 U.S.C. § 371(c)(2)):

a. ☐ is transmitted herewith.

b. ☒ is not required as the application was filed in English.

c. ☐ was previously transmitted by applicant on _____.
Date

d. ☐ will follow.

5. ☐ Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. § 371(c)(3)):

NOTE: *The Notice of January 7, 1993 points out that 37 C.F.R. § 1.495(a) was amended to clarify the existing and continuing practice that PCT Article 19 amendments must be submitted by 30 months from the priority date and this deadline may not be extended. The Notice further advises that: "The failure to do so will not result in loss of the subject matter of the PCT Article 19 amendments. Applicant may submit that subject matter in a preliminary amendment filed under section 1.121. In many cases, filing an amendment under section 1.121 is preferable since grammatical or idiomatic errors may be corrected." 1147 O.G. 29-40, at 36.*

a. ☐ are transmitted herewith.

b. ☐ have been transmitted

i. ☐ by the International Bureau.
Date of mailing of the amendment (from form PCT/1B/308): _____.

ii. ☐ by applicant on (date) _____.
Date

c. ☐ have not been transmitted as

i. ☐ applicant chose not to make amendments under PCT Article 19.
Date of mailing of Search Report (from form PCT/ISA/210.): _____.

ii. ☐ the time limit for the submission of amendments has not yet expired. The amendments or a statement that amendments have not been made will be transmitted before the expiration of the time limit under PCT Rule 46.1.

6. ☐ A translation of the amendments to the claims under PCT Article 19 (38 U.S.C. § 371(c)(3)):

a. ☐ is transmitted herewith.

b. ☐ is not required as the amendments were made in the English language.

c. ☐ has not been transmitted for reasons indicated at point 5(c) above.

7. ☒ A copy of the international examination report (PCT/IPEA/409)

☒ is transmitted herewith.

☐ is not required as the application was filed with the United States Receiving Office.

8. ☒ Annex(es) to the international preliminary examination report

a. ☒ is/are transmitted herewith.

b. ☐ is/are not required as the application was filed with the United States Receiving Office.

9. ☒ A translation of the annexes to the international preliminary examination report

a. ☐ is transmitted herewith.

b. ☒ is not required as the annexes are in the English language.

10. ☒ An oath or declaration of the inventor (35 U.S.C. § 371(c)(4)) complying with 35 U.S.C. § 115

    a. ☐ was previously submitted by applicant on _____ Date

    b. ☐ is submitted herewith, and such oath or declaration

        i. ☐ is attached to the application.

        ii. ☐ identifies the application and any amendments under PCT Article 19 that were transmitted as stated in points 3(b) or 3(c) and 5(b); and states that they were reviewed by the inventor as required by 37 C.F.R. § 1.70.

        iii. ☒ will follow.

II. Other document(s) or information included:

11. ☒ An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a):

    a. ☐ is transmitted herewith.

    b. ☒ has been transmitted by the International Bureau. Date of mailing (from form PCT/IB/308): _____.

    c. ☐ is not required, as the application was searched by the United States International Searching Authority.

    d. ☐ will be transmitted promptly upon request.

    e. ☐ has been submitted by applicant on _____ Date.

12. ☒ An Information Disclosure Statement under 37 C.F.R. §§ 1.97 and 1.98:

    a. ☐ is transmitted herewith.

        Also transmitted herewith is/are:

        ☐ Form PTO-1449 (PTO/SB/08A and 08B).

        ☐ Copies of citations listed.

    b. ☒ will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. § 371(c).

    c. ☐ was previously submitted by applicant on _____ Date.

13. ☐ An assignment document is transmitted herewith for recording.

    A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.

_____

_____

_____

14. ☒ Additional documents:
    a. ☐ Copy of request (PCT/RO/101)
    b. ☒ International Publication No. WO 01/19114 A1
        i. ☒ Specification, claims and drawing
        ii. ☐ Front page only
    c. ☒ Preliminary amendment (37 C.F.R. § 1.121)
    d. ☐ Other

15. ☒ The above checked items are being transmitted
    a. ☒ before 30 months from any claimed priority date.
    b. ☐ after 30 months.

16. ☐ Certain requirements under 35 U.S.C. § 371 were previously submitted by the applicant on _____, namely:

AUTHORIZATION TO CHARGE ADDITIONAL FEES

WARNING: *Accurately count claims, especially multiple dependant claims, to avoid unexpected high charges if extra claims are authorized.*

NOTE: "A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).

NOTE: "Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

☒ The Commissioner is hereby authorized to charge the following additional fees that may be required by this paper and during the entire pendency of this application to Account No. 14-23-0442

☒ 37 C.F.R. § 1.492(a)(1), (2), (3), and (4) (filing fees)

WARNING: *Because failure to pay the national fee within 30 months without extension (37 C.F.R. § 1.495(b)(2)) results in abandonment of the application, it would be best to always check the above box.*

☐ 37 C.F.R. § 1.492(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.492(d)), it might be best not to authorize the PTO to charge additional claim fees, except possible when dealing with amendments after final action.

☐ 37 C.F.R. § 1.17 (application processing fees)

☐ 37 C.F.R. § 1.17(a)(1)–(5) (extension fees pursuant to § 1.136(a).

☐ 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. § 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying . . . issue fee." From the wording of 37 C.F.R. § 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

☐ 37 C.F.R. § 1.492(e) and (f) (surcharge fees for filing the declaration and/or filing an English translation of an International Application later than 30 months after the priority date).

SIGNATURE OF PRACTITIONER

Reg. No.: 27,550

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Alfred A. Fressola
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PATENT
915-003.7

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the matter of: Ahnlund et al	)	
	)	
Serial No:	)	Group Art Unit
	)	Examiner:
Filed: Herewith	)	
	)	
International Application No: PCT/IB00/01323	)	
	)	
International Application Date: 5 September 2000	)	
	)	
For: Method for Quality Measurement in a Mobile Telecommunications System	)	

ASSISTANT COMMISSIONER OF PATENTS
WASHINGTON, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Please preliminarily amend the above-referenced application as follows:

In the Specification:

At page 1, prior to line 2, please insert a new heading and text as follows:

--CROSS-REFERENCE TO RELATED APPLICATIONS

Priority is claimed from International Application PCT/IB00/01323 filed 5 September 2000, which in turn claims priority from Great Britain application GB 9921007.2 filed 6 September 1999.--

Express Mail No. EV 005525742US

On page 1, prior to line 2, please insert a new heading as follows:

--Technical Field--.

Please replace the paragraph beginning at line 2 of page 1 with the following rewritten paragraph:

--This invention relates to measuring quality in networks such as cellular radio networks, and especially to measuring signal or service quality in adjacent cells in such networks. In particular, the networks may be bandwidth limited time division multiple access (TDMA) cellular networks or professional mobile radio (PMR) networks e.g. TETRA.--

On page 1, after the first occurrence of "TETRA" on line 6, please insert a new heading and paragraph as follows:

--Background of the Invention

The following examples given herein particularly address the GSM system but, as will be clear to those skilled in the art, the method has particular application to TETRA.--

On page 3, after line 27, please insert a new paragraph as follows:

--WO 97/15169 describes an arrangement where signal strength measurements are made by the mobile station, the signal strength measurements are delayed when the mobile is transmitting and receiving on a channel and then more frequent signal strength measurements are made when there is no communication. An alternative arrangement described in this document describes the mobile station "stealing" one or more time slots to perform the signal strength measurements by ignoring its task of receiving and/or transmitting information.--

On page 4, prior to line 13, please add a new heading as follows:

--Summary of the Invention--.

On page 7, prior to line 5, please add a new heading as follows:

--Brief Description of the Drawings--.

On page 7, prior to line 11, please add a new heading as follows:

--Best Mode for Carrying Out the Invention--.

In the Claims:

Claims 5, 6, 9, 14 and 15 have been amended.

5. (Amended) A method as claimed in claim 1, comprising the step of the mobile station transmitting to a cell site unit information indicating the estimated levels of interference with signals on at least two of the communication channels.

6. (Amended) A method as claimed in claim 1, wherein the mobile station is in traffic communication on a traffic communication channel, the telecommunications system comprises a handover controller for controlling handover of the mobile station from the current communication channel to another one of the communication channels, and the method comprises the steps of:

the mobile station communicating to the handover controller via the current cell site unit information indicating the estimated levels of quality with signals on at least two of the communication channels; and

the handover control unit determining to which of the cell site units to hand over traffic communication of the mobile station on the basis of at least that information indicating the estimated levels of interference.

9. (Amended) A method as claimed in claim 1, wherein the mobile station stores an indication of a timing of the said signals on at least one of the communication channels

and the mobile station interrupts another operation to receive the said signals at a time dependent on the stored indication of a timing.

14. (Amended) A mobile station as claimed in claim 13, wherein the interference estimation unit comprises a Viterbi equaliser.

15. (Amended) A mobile station as claimed in claim 14, wherein the channel analysis unit is capable of receiving via the receiver information specifying the said communication channels.

Claims 17 and 18 have been added.

17. (New) A mobile station as claimed in claim 12, wherein the interference estimation unit comprises a Viterbi equaliser.

18. (New) A mobile station as claimed in claim 11, wherein the channel analysis unit is capable of receiving via the receiver information specifying the said communication channels.

In the Abstract:

After the claim pages, add new page 20 with the following:

--Abstract of the Disclosure

A method for operating a radio telecommunications system comprising a mobile station and one or more cell site units capable of communicating by radio with the mobile station on at least two communication channels; the method comprising: the mobile station receiving signals on each of the communication channels; and the mobile station determining an estimate of the level of interference with signals on each of the communication channels.--

915-003.7

Remarks

This preliminary amendment is filed for the purpose of placing the application into standard U.S. format. Claims 5, 6, 9, 14 and 15 have been amended. Claims 17 and 18 have been added. Consideration and allowance of the claims is earnestly solicited.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version with markings to show changes made."

Respectfully submitted,

Date: 3/6/02

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(203) 261-1234

AAF/aks

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

Paragraph beginning at line 2 of page 1 has been amended as follows:

This invention relates to measuring quality in networks such as cellular radio networks, and especially to measuring signal or service quality in adjacent cells in such networks. In particular, the networks may be bandwidth limited time division multiple access (TDMA) cellular networks or professional mobile radio (PMR) networks e.g. TETRA. [The following examples given herein particularly address the GSM system but, as will be clear to those skilled in the art, the method has particular application to TETRA].

In the Claims:

5. (Amended) A method as claimed in [any preceding] claim 1, comprising the step of the mobile station transmitting to a cell site unit information indicating the estimated levels of interference with signals on at least two of the communication channels.

6. (Amended) A method as claimed in [any preceding] claim 1, wherein the mobile station is in traffic communication on a traffic communication channel, the telecommunications system comprises a handover controller for controlling handover of the

mobile station from the current communication channel to another one of the communication channels, and the method comprises the steps of:

the mobile station communicating to the handover controller via the current cell site unit information indicating the estimated levels of quality with signals on at least two of the communication channels; and

the handover control unit determining to which of the cell site units to hand over traffic communication of the mobile station on the basis of at least that information indicating the estimated levels of interference.

9. (Amended) A method as claimed in [any of claims 1 to 8] claim 1, wherein the mobile station stores an indication of a timing of the said signals on at least one of the communication channels and the mobile station interrupts another operation to receive the said signals at a time dependent on the stored indication of a timing.

14. (Amended) A mobile station as claimed in claim [12 or] 13, wherein the interference estimation unit comprises a Viterbi equaliser.

15. (Amended) A mobile station as claimed in [any of claims 11 to] claim 14, wherein the channel analysis unit is capable of receiving via the receiver information specifying the said communication channels.

METHOD FOR QUALITY MEASUREMENT IN A MOBILE TELECOMMUNICATIONS SYSTEM

This invention relates to measuring quality in networks such as cellular radio networks, and especially to measuring signal or service quality in adjacent cells in such networks. In particular, the networks may be bandwidth limited time division multiple access (TDMA) cellular networks or professional mobile radio (PMR) networks e.g. TETRA. The following examples given herein particularly address the GSM system but, as will be clear to those skilled in the art, the method has particular application to TETRA.

Figure 1 shows schematically the configuration of a typical wireless cellular telecommunications network. The network comprises a number of base-stations (BSs) 1, 2, 3 etc. Each base-station has a radio transceiver capable of transmitting radio signals to and receiving radio signals from the area of an associated cell 4, 5, 6 etc. By means of these signals the base-stations can communicate with a terminal 7 which may be a mobile station (MS) in the associated cell. That terminal itself includes a radio transceiver. Each base station is connected via a base station controller (BSC) 8 to a mobile switching centre (MSC) 9, which is linked in turn to the public telephone network (PSTN) 10. By means of this system a user of the mobile station 7 can establish a telephone call to the public network 10 via the base station in whose cell the mobile station is located. The location of the terminal 7 could be fixed (for example if it is providing radio communications for a fixed building) or the terminal could be moveable (for example if it is a hand portable transceiver or mobile phone).

If the mobile station 7 moves from one cell to another there is a need for it to switch from communicating with one base station to communicating with another. This process is known as handover. As an example, at location 11 the mobile station 7 communicates with base station 1. If the mobile station 7 moves from location 11 to location 12 along route 13 then at some point it must hand over from communicating with base station 1 to communicating with at least one of

base stations 2 and 3. When the mobile station 7 is communicating via base station 1 with another terminal unit 14 the communications data passes across the radio link between the mobile station and the base station 1, fixed wire link 15 between the base station 1 and the corresponding BSC 8 and then onward to terminal 14. When the mobile station 7 is communicating with the other terminal unit 14 via, say, base station 2 the communications data passes across the radio link between the mobile station and the base station 2, fixed wire link 16 between the base station 2 and the corresponding BSC 8 and then onward to terminal 14.

In TDMA systems each mobile station communicates with an associated base station in an allocated time slot and on a certain carrier frequency, which may also be allocated. In most such systems it is the responsibility of the respective BSC to control signal quality in the system. If signal quality between a certain mobile station and the associated base station is low then the BSC can control the mobile station or the associated base station to increase its transmission power or control the mobile station to hand over to another base station, with the aim of increasing signal to interference ratio. If signal quality is excessively high then transmission power can be reduced to reduce interference and conserve battery power. Examples of such a system are those that operate according to the GSM (Global System for Mobile Communications) protocol.

Signal quality could be estimated by means of bit error rate, field strength signal to interference ratio or other means. In order to estimate signal quality it is normal for a mobile station to estimate the field strength of a principal carrier frequency for each of the cells near the mobile station's current location. These estimates are reported to the base station that is currently serving the mobile station - that is the base station with which the mobile station is currently associated for the communication of traffic data. A list of principal carrier frequencies for the nearby cells is stored by the BSC, which causes base stations under its control to use their control channels to transmit that list to mobile stations.

In a system such as GSM, the frame structure of the TDMA transmission protocol provides a sufficient period between transmissions that a mobile station is able to retune to a different frequency to measure the field strength of the principal carrier frequency of another cell on that frequency. In other systems a mobile station may be able to communicate with more than one base station simultaneously. Each base station transmits on its principal carrier frequency at maximum power so that the mobile station is able to make a baseline comparison of the field strengths of different adjacent cells. If a base station serves more than one cell then it uses a different principal frequency for each of those cells.

This method has a number of problems. It only permits a relative measure of the field strength of an adjacent cell to be determined; the relative measure could be influenced by substantial co-channel interference on the principal carrier frequency, making the frequency unsuitable for handover. The field strength comparison only gives an indication of the strengths of the principal carrier frequencies of different cells and no information about the other carrier frequencies in those cells. It may happen that when a mobile station is handed over to an adjacent cell whose principal carrier frequency has been determined to have the strongest monitored field strength, at another carrier frequency there is so much co-channel interference that the mobile station is unable to communicate; therefore if such a handover were made the call would be dropped. Therefore, when a handover is taking place a BSC must hold available the previously allocated time slot in the cell previously serving the mobile station until the handover to the new cell is confirmed as successful. Then, if the level of interference is so high that the handover would be unsuccessful the mobile station can be handed back to the previous serving cell. This arrangement reduces network capacity because it requires two slots to be held open during a hand over.

WO 97/15169 describes an arrangement where signal strength measurements are made by the mobile station, the signal strength measurements are delayed

when the mobile is transmitting and receiving on a channel and then more frequent signal strength measurements are made when there is no communication. An alternative arrangement described in this document describes the mobile station "stealing" one or more time slots to perform the signal strength measurements by ignoring its task of receiving and/or transmitting information.

There is therefore a need for a way to determine more accurately the quality of service that can be expected on a new carrier frequency to which a mobile station

may be handed over, for example by means of estimating field strength and co-channel interference on that new carrier frequency.

It would also be desirable to reduce the amount of co-channel interference on a cell's principal carrier frequency. Such a solution could allow a network incorporating IUO (intelligent underlay overlay) to carry an even greater capacity of traffic. Present schemes for IUO networks involve a relatively loose cellular reuse pattern of principal carrier frequencies - often termed the regular TRX (transmission) frequencies. Each of those frequencies carries control channel information for its cell and is transmitted at constant maximum power. A relatively tight reuse pattern is employed for the other carrier frequencies in each cell - termed the super TRX frequencies. IUO is an interference-limited solution best employed for high capacity urban mobile telecommunications networks.

According to one aspect of the present invention there is provided a method for operating a radio telecommunications system comprising a mobile station and one or more cell site units capable of communicating by radio with the mobile station on at least two communication channels; the method comprising: the mobile station receiving signals on each of the communication channels; and the mobile station determining an estimate of the level of interference with signals on each of the communication channels.

The method may also comprise the step of transmitting to the mobile station information specifying the communication channels. The mobile station may suitably store that information. In the step of receiving signals the mobile station preferably receives signals on the channels as transmitted to it. The said information specifying the communication channels suitably specifies a frequency for each of the communication channels. The mobile station may then, in the said step of receiving, receive signals on communication channels whose carrier frequencies are specified by the said information.

Having determined estimated levels of interference the mobile station preferably transmits information defining some or all of those estimated levels to a cell site unit information indicating the estimated levels of interference. If only some of the levels of interference are transmitted then those are preferably the lowest levels of interference.

Preferably the mobile station is in traffic communication on a traffic communication channel, the telecommunications system comprises a handover controller for controlling handover of the mobile station from the current communication channel to another one of the communication channels, and the method comprises the steps of: the mobile station communicating to the handover controller via the current cell site unit information indicating the estimated levels of interference with signals on at least two of the communication channels; and the handover control unit determining to which of the cell site units to hand over traffic communication of the mobile station on the basis of at least that information indicating the estimated levels of interference. The step of the handover control unit determining may comprise determining to which communication channel of one of the cell site units to hand over traffic communication of the mobile station on the basis of at least that information indicating the estimated levels of interference. The handover control unit may determine to hand over to a channel having one of the lowest estimated levels of interference.

According to a second aspect of the present invention there is provided a mobile station for operation in a telecommunications system comprising at least two cell site units each capable of communicating by radio with the mobile station on at least two communication channels; the mobile station comprising: a receiver capable of receiving signals from a cell site units on a communication channel; an interference estimation unit for estimating the level of interference on a communication channel on which the receiver receives signals; and a channel analysis unit coupled to the receiver and the interference estimation unit for causing the receiver to receive signals from each of the cell site units on each of the respective communication channels in turn and receiving from the

interference estimation unit an estimate of the level of interference on each of those channels.

The interference estimation unit is suitably capable of estimating the level of interference by performing an error correction and/or signal recovery operation on received signals. The said operation is suitably performed on a training sequence of the received signals. The interference estimation unit may comprise a Viterbi equaliser.

The channel analysis unit may be capable of receiving via the receiver information specifying the said communication channels.

The present invention may be implemented in a TDMA telecommunications system and/or in a cellular telephone system. The present invention is suitably implemented in a GSM system. In a GSM system the handover control unit may be a BSC (base station controller). The cell site unit may be a base-station or a part of a base station.

The present invention may be used to assist in the operation of handovers of the mobile station from traffic communication on one channel to traffic communication on another channel. In one arrangement the handovers may be inter-cell handovers. In that case the communication channels for which a level of interference is estimated are channels of different cells (and therefore different cell site units). In another arrangement the handovers may be intra-cell handovers. In that case the communication channels for which a level of interference is estimated may be channels of the same cell (and therefore the same cell site unit). If the system is capable of performing a general handover operation from one channel to another then the communication channels for which a level of interference is estimated may be of the same or different cells.

The Base Station Controller uses the determined information about the different levels of co-channel interference in the adjacent cells, at the monitored carrier

frequencies, together with signalling information including the availability of time slots at those frequencies, to optimise the target cell and target frequency into which the mobile station will be handed over to maximise a successful handover operation.

The present invention will now be described by way of example, with reference to the accompanying drawings, in which:

figure 1 shows a cellular radio network;

figure 2 shows a mobile station and a set of six cells;

figure 3 is a block diagram showing the chain of events in implementing handovers.

Figure 1 depicts a dedicated mobile station 50 in a central serving cell 51 communicating with the base station 40 of that cell. By way of illustration only is shown a cluster of five adjacent cells 30 each having a first carrier frequency transceiving element denoted TRX_1. Following the principles of reuse in a cellular telephone system such as GSM, each of the base stations 31 in the adjacent cells 30 operates at a different principal frequency. The number of adjacent cells is given by way of example only and in no way limits the invention to this number of cells.

The principal transmission frequency from a base station in each cell of a GSM cellular system is transmitted at maximum power. Any additional transmission frequencies in use in the cell, are subject to variable power control. Hence co-channel interference from the base station transceivers predominantly comes from the principal carrier frequency transmissions since these are always transmitted at maximum power. The reason that these do not employ variable power control is to provide a base line comparison of field strengths so that the mobile station is able to gather data so that it can be determined when handovers to adjacent cells must occur.

According to the GSM specification, the mobile station is to receive information on the control channel about the adjacent cells to the one in which it is currently located. The control channel is found on the principal carrier frequency of the serving base station TRX_1. Within the frame structure of GSM, the dedicated mobile station is allocated for traffic transmission and reception a time slot comprising one eighth of a time frame. The duration of one time frame is 4.6ms. In this way the mobile station generally has sufficient time between transmissions with its serving base station to retune to the first carrier frequency TRX_1, of an adjacent base station and perform a measurement of that adjacent cell's field strength. The time frames are arranged into a repeating frame structure of 26 time frames. For 25 of the 26 time frames, the dedicated mobile station transmits to the serving base station. Frame 26 is not used for this purpose. Frame 26 provides the possibility for the mobile station to synchronise with an adjacent TRX_1 to read that base station's identity code (BSIC) which is found on the first time slot of the TRX_1. This is necessary to confirm that the field strength measurement is indeed from the adjacent cell with that particular identification BSIC. It can happen that spurious signals from more distant cells operating at the same TRX_1 frequency are picked up and measured by the mobile station. The empty time frame, frame 26, occurs every (26 × 4.6) ms, i.e. every 119.6ms. IN the best case, this provides the dedicated mobile station sufficient time every one second time interval to synchronise with 8 other first carrier frequencies, one for each of 8 adjacent cells.

In one embodiment of the present invention use is made of this recurring event. While reading the burst which contains the BSIC the mobile station reads the training sequence which comprises a coded sequence present in every burst of GSM transmissions. The training sequence is used to determine the degree by which a transmission may have been corrupted by interference. In one embodiment, the mobile station passes the burst transmission comprising the training sequence, received from an adjacent cell's TRX_1 to which the mobile station is synchronised in time frame 26, to the mobile station's Viterbi equaliser. This enables the degree of co-channel interference to be measured using the

Viterbi algorithm, which is able to determine the amount of error correction required to restore the received signal to resemble more closely the expected signal as determined by prior knowledge of some characteristic of the signal to be received, such as the training sequence. In this instance, the ability of the Viterbi equaliser to restore a corrupted signal such that the error corrected signal output from the Viterbi equaliser includes the training sequence itself correspondingly provides a measure of the co-channel interference. The Viterbi equaliser can determine a measure of the error correction required to restore the training sequence, or indeed of any expected coded sequence, and correspondingly, the mobile station is able to provide a differential measure of the co-channel interference on the first carrier frequency of the monitored adjacent cells.

The determination of the level of co-channel interference through the analysis of the training sequence is made more accurate and reliable, the more often the mobile station reads the BSIC of the adjacent cell at the first carrier frequency. Correspondingly, it is possible to improve the determination of the level of co-channel interference by enabling the mobile station to read the BSIC more often. This is effected by providing the mobile station with information about the timing differences and the relative frame number offset of the adjacent cells in the broadcast control channel information transmitted on the mobile station's current serving cell. It is through the provision of this timing difference and frame number offset information that the mobile station is able to make intelligent choices as to which BSICs are easier to read and correspondingly attempt to read them in a particular sequence.

More precisely, the information relating to the adjacent cells includes the real-time difference (RTD) between two adjacent cells describing the difference in frame number, and the time frame alignment offset within a frame between a particular adjacent cell and the serving cell.

The RTD between a particular adjacent cell and a mobile station's serving cell can be transmitted by the network on the control channel. This enables the

mobile station to pre-determine when approximately the BSIC of this adjacent cell will be sent, before the mobile station has read the BSIC the first time. Consequently, the mobile station can schedule its attempts to read the BSICs of several adjacent cells more effectively, which enables the mobile to read BSICs more often. Without this pre-knowledge of when the BSICs will occur, the mobile station must randomly search for the BSICs which requires typically more than one search frame (frame #26). Thus, transmission of RTDs over the broadcast control channel enables more accurate estimates of co-channel interference to be made.

With mobile location technology currently under development, these RTD transmissions are made for a different purpose, and the invention involves a novel use of these RTD transmissions. Correspondingly, no additional signalling load is imposed on the network by the present invention.

In another embodiment of the invention, an alternative coded signal characteristic may be used. If the mobile station has received suitable information from the base station controller via a base station, or which originates from hardware associated with the base station itself, or if the mobile station is pre-programmed with the characteristic that will be received, the Viterbi equaliser can be employed to measure the error correction required to restore a received signal into a form comprising the said characteristic.

Now, by means of the above procedure, instead of a mobile station simply using the empty frame 26 for checking the BSIC code, also the received signal comprises a training sequence and this can be used to estimate a level of co-channel interference on the first carrier frequency TRX_1.

Furthermore, this approach may be used to allow more intelligent handover decisions to be made by the system. A conventional GSM handover involves the steps of monitoring the field strength at the first carrier frequency for each adjacent cell, determining the relative difference in field strengths of adjacent cells

as an approximate indication of which cell is most likely the closest, and then performing a "blind" handover into a candidate adjacent cell while holding the serving cell time slot in case of co-channel interference in the said candidate adjacent cell. Instead, using the above approach it is possible to prioritise an "intelligent" handover protocol in which the base station controller is programmed to maximise availability of a time slot at the first carrier frequency of the adjacent cell. To achieve this an "intelligent" intracell handover protocol is used. According to that protocol, when an adjacent cell has been identified as having one of the lowest levels of co-channel interference at the respective monitored first carrier frequency, through the monitoring of the level of error-correction necessary to recover a signal from the cell while the mobile station was synchronised to it, that cell can be selected for the mobile station to be handed over to.

Conventional handover procedures do not provide the capability to monitor the degree of co-channel interference on links to nearby cells. In prior art systems it is conventional for provisional handovers to be made "blindly" to any available time slot at any of the available carrier frequencies in a candidate adjacent cell for which a statistical basis for successful handover has been planned in by the network planner. Such systems do not provide for the selective analysis of adjacent cells to improve the likelihood of successful handover based on contemporaneous interference patterns.

A base station controller according to the present invention may employ both the above-described concepts of "intelligent handover protocol" and "intelligent intracell handover protocol". In this arrangement a base station controller can prioritise handover to an adjacent cell at a first carrier frequency for which the co-channel interference has been detected to be lowest or one of the lowest among carrier frequencies of neighbouring cells. Furthermore, the base station controller can prioritise intracell handover from the principal carrier frequency in the new serving cell to one of the other serving cell carrier frequencies $TRX_{2,3,4...N}$.

A similar co-channel interference monitoring method can be employed to select a carrier frequency for intracell handover as has been described for selecting one of the optimum adjacent cells for handover from a previous serving cell to a current serving cell. In an intracell handover it may additionally be advantageous for the base station controller to indicate to the mobile station which carrier frequency in that same cell is to be monitored for interference. Since the mobile station is synchronised with the serving cell it can receive this information according to the normal GSM signalling protocols. This does not increase the workload on the BSC, or the signalling between the BSC and the base station.

Depending on the geographical position of the mobile station within the current serving cell, the co-channel interference of the different carrier frequencies within the same cell may differ substantially. Furthermore, variable power control of other carrier frequencies within the same cell (if this is in use) may make reception of a signal difficult. However, the absence of a signal will logically indicate that the co-channel interference is very low. A further advantage of the intelligent intracell handover protocol is that a characteristic of one of the other carrier frequencies in the same cell can be monitored at any moment (e.g. in any time frame) without having to wait for the time when measuring normally occurs (e.g. in a specified time frame, such as frame 26 in a normal GSM system). This can be done because the mobile station is always already synchronised with its serving cell. The mobile station needs only one time slot to retune to one of the other carrier frequencies, a second time slot to receive a synchronised burst transmission, and a third time slot to retune to its allocated carrier frequency.

It is preferred that the mobile station continues to periodically monitor the co-channel interference of adjacent cells in the manner described above.

Figure 3 illustrates a non-limiting example of a procedure for handover according to the present invention as implemented in conjunction with a normal GSM system.

The BSC provides the mobile station with a list of the adjacent-cell first carrier frequencies. The mobile station then makes use of frame 26 to monitor the co-channel interference on the first carrier frequency. The mobile station then sends this data to the BSC in order for the BSC to affect an intelligent handover to an adjacent cell at one of the optimum monitored TRX_1 frequencies where a time slot is available. While all other standard processes continue, the mobile station is instructed to monitor the co-channel interference on other carrier frequencies $TRX_{2,3,4..N}$ of the new serving cell.

The BSC knows the time slots that are available on the other carrier frequencies within that same serving cell. Therefore, improved and "intelligent" decisions can be made by the BSC to direct the mobile station to investigate, selectively, the co-channel interference at particular time slots at other carrier frequencies in the same cell.

The present invention may provide a particular advantage in the planning of high capacity Intelligent Underlay Overlay (IUO) networks. These networks provide a higher capacity by using a loose reuse pattern of first carrier frequencies, termed "regular carrier frequencies", (TRX_1s), and a tighter reuse pattern of additional carrier frequencies, termed "super carrier frequencies", ($TRX_{2,3,4..N}$s). The network planner of an IUO network plans according to statistical probabilities of the use of the network within the limitations of a conventional "blind" handover protocol. By means of an aspect of the present invention an "intelligent" handover protocol can be used, allowing allows the mobile station to gather data to allow an intelligent handover to be effected. If it is assumed that an intelligent handover protocol as described herein will be used then a more efficient use of bandwidth can be achieved because the reuse factor for regular TRX cells in an IUO planned network can be reduced. This reduction would be expected to increase the overall interference of the network. However, the handover method described above makes it possible to remotely analyse co-channel interference in adjacent cells. This remote analysis of adjacent co-channel interference, which affords the mobile station the opportunity of being handed over to an adjacent cell having

one of the lowest levels of co-channel interference, can overcome the increased interference of the tighter reuse factor of the regular IUO frequency TRX_1 s.

Several factors affect the amount by which an intelligent handover protocol and/or an intelligent intracell handover protocol as described herein increase the efficiency of usage of bandwidth in a limited bandwidth network (e.g. a GSM network). One factor to note is that the more frequencies used in a network the greater the advantage that would be expected to be achieved. The protocols are especially advantageous within cells where there are a higher number of carrier frequencies, i.e. $TRX_{2,3,..N}$ increased bandwidth efficiency increasing with higher N.

The mobile station could be capable of determining the adjacent cell co-channel interference to varying degrees, to match the different processing requirements of different base station controllers' functionalities. The mobile station could perform some or all of the processing described above as being performed on the network side, and vice versa. This may make it easier to overlay a system of this type on an existing network. Alternative and/or additional devices to the Viterbi equaliser may be provided in the mobile station to perform co-channel interference evaluation of the monitored adjacent cell first carrier frequencies. For example, the monitoring could be performed by measuring data rate and/or error rate (e.g. bit error rate) for a communication on a principal or broadcast channel or a dedicated measurement channel. The system could provide programmed coded signals carried by dedicated time slots in the network for the purpose of monitoring the co-channel interference.

There is no need for co-channel interference evaluation to be restricted to the principal carrier frequencies. Correspondingly, the BSC may be programmed to instruct the mobile station to monitor any carrier frequency of an adjacent cell, preferably after that cell/frequency has been identified as a potential candidate for handover. The necessary modifications to the power transmission requirements of that carrier frequency in the adjacent base station could be logically inferred.

It is also possible to use the data that can be gathered in a system of the type described above to help in network management, to provide additional information that could be of use to network operators, for instance for network planning purposes. As an example, engineers may be installing an indoor network to provide an indoor coverage solution to complement an existing outdoor network. During such an operation, the engineers may be investigating which subset of available base station frequencies of a larger number of possible frequencies are subject to the least interference at a particular location. By means of handsets and/or network-side apparatus equipped as described above it is relatively easy for the engineers to make a sound choice for frequency allocation for the said indoor base stations based upon this quality criterion.

The handover and other procedures described above could be implemented in an existing GSM network by means of software and/or hardware modifications to existing network equipment of at least 2nd and 3rd generation GSM systems.

The embodiment described emphasises a network-based handover decision, however, in some technologies, e.g. TETRA, the handover decision is mobile based. The method of the invention is equally advantageous for mobile based handover decisions and is thus equally applicable to systems such as TETRA.

The applicant draws attention to the fact that the present invention may include any feature or combination of features disclosed herein either implicitly or explicitly or any generalisation thereof, without limitation to the scope of any of the present claims. In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention.

CLAIMS

1. A method for operating a radio telecommunications system comprising a mobile station and one or more cell site units capable of communicating by radio with the mobile station on at least two communication channels; the method comprising:

the mobile station receiving signals on each of the communication channels; and

the mobile station determining an estimate of the level of interference with signals on each of the communication channels.

2. A method as claimed in claim 1, comprising the step of transmitting to the mobile information specifying the communication channels.

3. A method as claimed in claim 2, wherein the said information specifies a frequency for each of the communication channels.

4. A method as claimed in claim 3, wherein the said step of receiving comprises receiving signals on communication channels whose carrier frequencies are specified by the said information.

5. A method as claimed in any preceding claim, comprising the step of the mobile station transmitting to a cell site unit information indicating the estimated levels of interference with signals on at least two of the communication channels.

6. A method as claimed in any preceding claim, wherein the mobile station is in traffic communication on a traffic communication channel, the telecommunications system comprises a handover controller for controlling handover of the mobile station from the current communication channel to another one of the communication channels, and the method comprises the steps of:

the mobile station communicating to the handover controller via the current cell site unit information indicating the estimated levels of quality with signals on at least two of the communication channels; and

the handover control unit determining to which of the cell site units to hand over traffic communication of the mobile station on the basis of at least that information indicating the estimated levels of interference.

7. A method as claimed in claim 6, wherein the step of the handover control unit determining comprises determining to which communication channel of one of the cell site units to hand over traffic communication of the mobile station on the basis of at least that information indicating the estimated levels of interference.

8. A method as claimed in claim 7, wherein the handover control unit determines to hand over to a channel having one of the lowest estimated levels of interference.

9. A method as claimed in any of claims 1 to 8, wherein the mobile station stores an indication of a timing of the said signals on at least one of the communication channels and the mobile station interrupts another operation to receive the said signals at a time dependent on the stored indication of a timing.

10. A method as claimed in claim 9, wherein the indication of a timing is an indication of the difference in timing between signals on the said communication channels.

11. A mobile station for operation in a telecommunications system comprising at least two cell site units each capable of communicating by radio with the mobile station on at least two communication channels having different frequencies; the mobile station comprising:

a receiver capable of receiving signals from a cell site units on a communication channel;

an interference estimation unit for estimating the level of interference on a communication channel on which the receiver receives signals; and

a channel analysis unit coupled to the receiver and the interference estimation unit for causing the receiver to receive signals from each of the cell site units on each of the respective communication channels in turn and receiving from the interference estimation unit an estimate of the level of interference on each of those channels.

12. A mobile station as claimed in claim 11, wherein the interference estimation unit is capable of estimating the level of interference by performing an error correction and/or signal recovery operation on received signals

13. A mobile station as claimed in claim 12, wherein the said operation is performed on a training sequence of the received signals.

14. A mobile station as claimed in claim 12 or 13, wherein the interference estimation unit comprises a Viterbi equaliser.

15. A mobile station as claimed in any of claims 11 to 14, wherein the channel analysis unit is capable of receiving via the receiver information specifying the said communication channels.

16. A method for operating a radio telecommunication system comprising a mobile station and one or more cell site units capable of communicating by radio with the mobile station on at least two communication channels; the method comprising:

the mobile station storing an indication of the timing difference between signals on the communication channels;

the mobile station receiving signals on one of the communication channels; and

the mobile station interrupting said receiving in order to receive signals on another of the communication channels at a time dependent on the stored indication.

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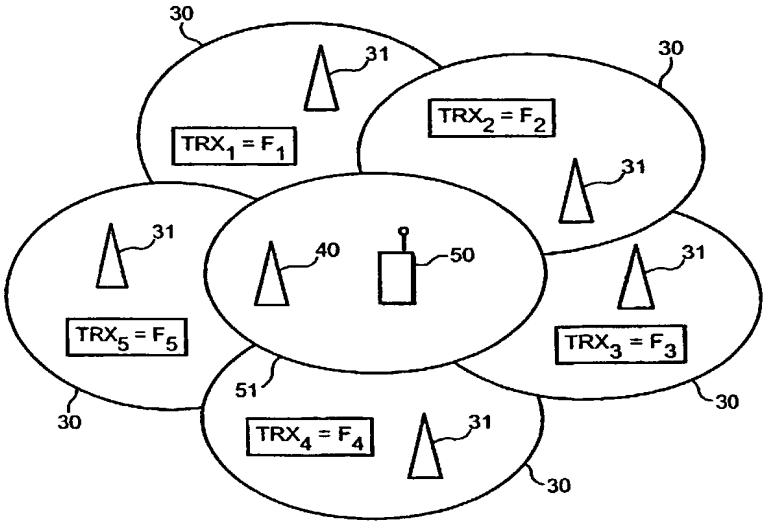

(57) Abstract: A method for operating a radio telecommunications system comprising a mobile station and one or more cell site units capable of communicating by radio with the mobile station on at least two communication channels; the method comprising: the mobile station receiving signals on each of the communication channels; and the mobile station determining an estimate of the level of interference with signals on each of the communication channels.

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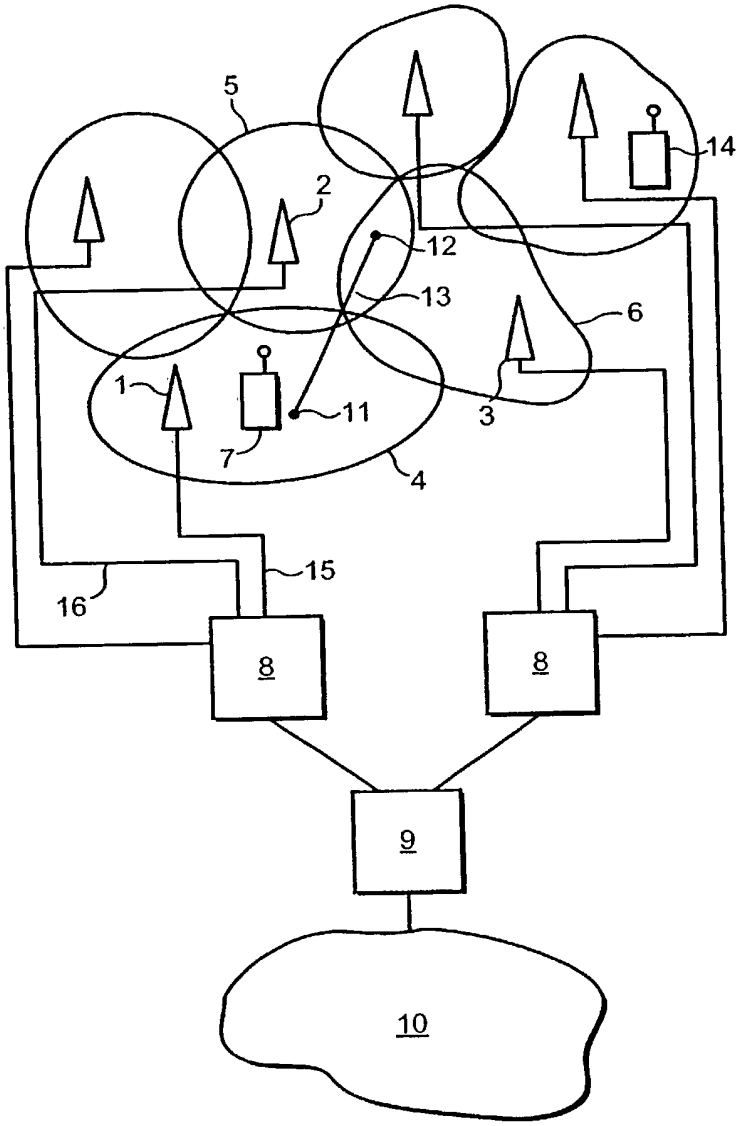

FIG. 1

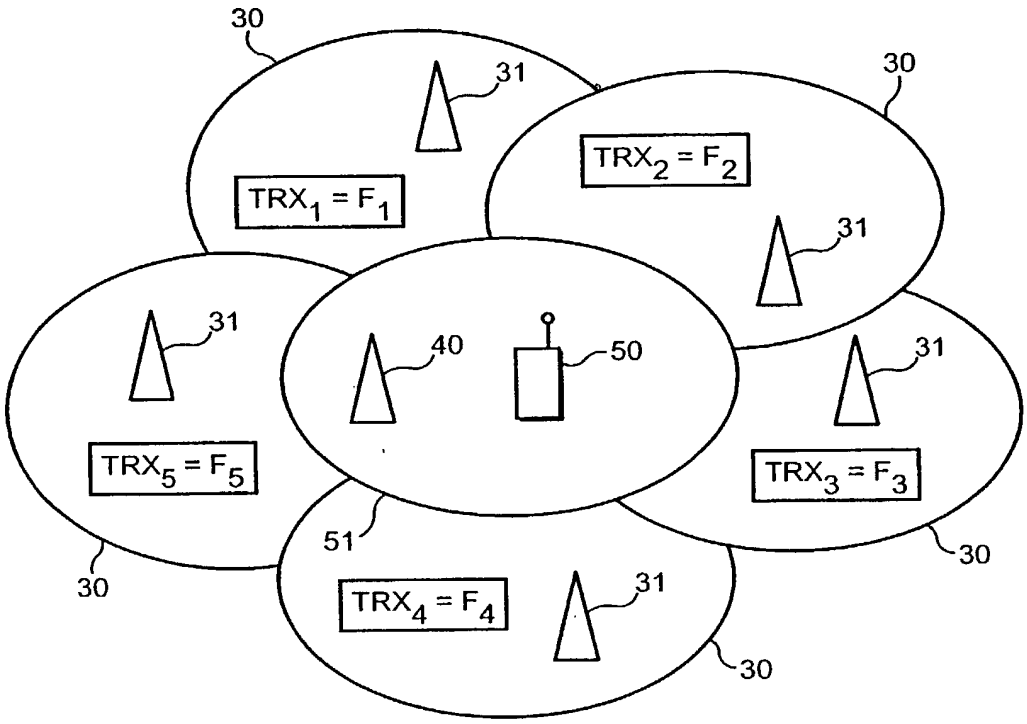
30
31
TRX1 = F1
30
TRX2 = F2
31
31
40
50
31
TRX5 = F5
TRX3 = F3
51
30
30
TRX4 = F4
31
30

FIG. 2

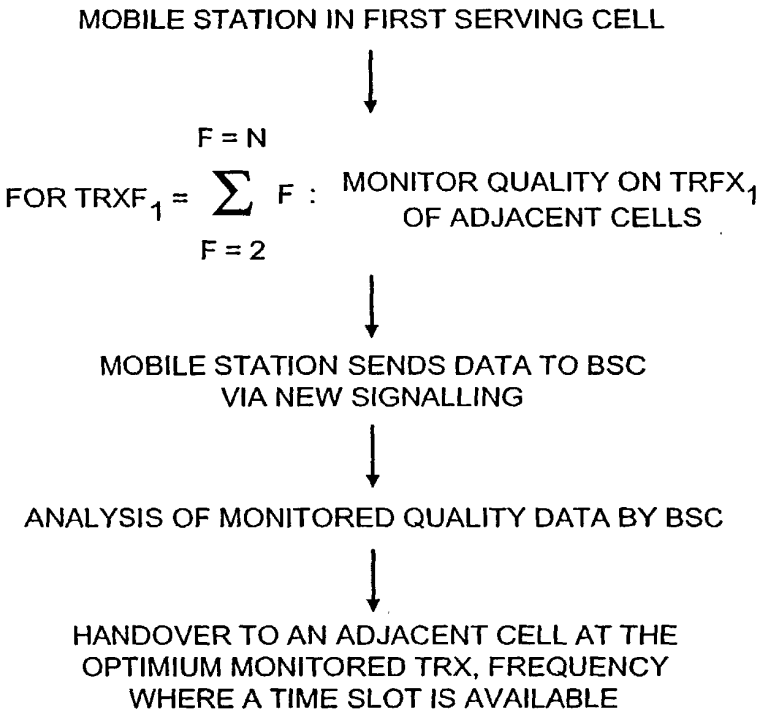
MOBILE STATION IN FIRST SERVING CELL
FOR TRXF1 = Σ F : MONITOR QUALITY ON TRFX1 OF ADJACENT CELLS
F = N
F = 2
MOBILE STATION SENDS DATA TO BSC VIA NEW SIGNALLING
ANALYSIS OF MONITORED QUALITY DATA BY BSC
HANDOVER TO AN ADJACENT CELL AT THE OPTIMIUM MONITORED TRX, FREQUENCY WHERE A TIME SLOT IS AVAILABLE

FIG. 3

COMBINED DECLARATION AND POWER OF ATTORNEY

(Docket Number)

As a below named inventor, I hereby declare that: **915-003.7**

- my residence, post office address and citizenship are as stated below next to my name;
- I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: A Method for Quality Measurement in a Mobile Telecommunications System
- the specification of which is attached hereto unless the following box is checked: [X]. If the box is checked,

the application was filed on March 6, 2002
as U.S. Application Number 10/070,410
or PCT International Application Number
and was amended on (if applicable). March 6, 2002

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application			Priority Not Claimed
PCT/IB00/01323 (Application Number)	International (Country)	5 September 2000 (Day/Month/Year Filed)	☐
9921007.2 (Application Number)	Great Britain (Country)	6 September 1999 (Day/Month/Year Filed)	☐

To the extent permitted by rule or law, I hereby incorporate by reference the Prior Foreign Application(s) listed above.

I hereby claim the benefits under 35 U.S.C. §119(e) of any United States provisional application(s) listed below:

(Provisional Application Number)	(Day/Month/Year Filed)
(Provisional Application Number)	(Day/Month/Year Filed)

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s), or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose information which is material to patentability, as defined in 37 CFR §1.56, which became available between the filing date of the prior application and the national or PCT International filing date of this application.

(Application Number)	(Day/Month/Year Filed)	(Status--patented, pending, abandoned)
(Application Number)	(Day/Month/Year Filed)	(Status--patented, pending, abandoned)

COMBINED DECLARATION AND POWER OF ATTORNEY

(Docket Number)
915-003.7

As a below named inventor, I hereby declare that:

- my residence, post office address and citizenship are as stated below next to my name;
- I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: A Method for Quality Measurement in a Mobile Telecommunications System
- the specification of which is attached hereto unless the following box is checked: [X]. If the box is checked,

  the application was filed on March 6, 2002
  as U.S. Application Number 10/070,410
  or PCT International Application Number
  and was amended on (if applicable). March 6, 2002

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application			Priority Not Claimed
PCT/IB00/01323 (Application Number)	International (Country)	5 September 2000 (Day/Month/Year Filed)	☐
9921007.2 (Application Number)	Great Britain (Country)	6 September 1999 (Day/Month/Year Filed)	☐

To the extent permitted by rule or law, I hereby incorporate by reference the Prior Foreign Application(s) listed above.

I hereby claim the benefits under 35 U.S.C. §119(e) of any United States provisional application(s) listed below:

(Provisional Application Number)	(Day/Month/Year Filed)
(Provisional Application Number)	(Day/Month/Year Filed)

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s), or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose information which is material to patentability, as defined in 37 CFR §1.56, which became available between the filing date of the prior application and the national or PCT International filing date of this application.

(Application Number)	(Day/Month/Year Filed)	(Status--patented, pending, abandoned)
(Application Number)	(Day/Month/Year Filed)	(Status--patented, pending, abandoned)

The undersigned hereby authorizes the U.S. firm of **Ware, Fressola, Van Der Sluys & Adolphson LLP** to accept and follow instructions from the English firm of **Page White & Farrer** as to any action to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. firm and the undersigned. In the event of a change in the persons from whom instructions may be taken, the U.S. firm will be so notified by the undersigned.

I hereby appoint the attorney(s) and/or agent(s) assigned to the customer number listed below, as may from time to time be amended, belonging to the U.S. firm of **Ware, Fressola, Van Der Sluys & Adolphson LLP**, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Customer Number

4955

Address all telephone calls to: Ware, Fressola, Van Der Sluys & Adolphson LLP at (203) 261-1234. **Address all correspondence to:** Alfred A. Fressola

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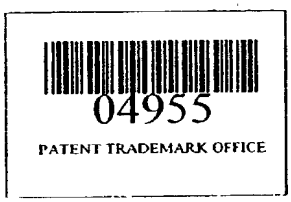

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Hans AHNLUND Full name of sole or first inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	26/06/02 Date
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Alexander ESSER Full name of second inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
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Philip WESBY Full name of third inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
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☒ Additional inventors are being named on separately numbered sheets attached hereto.

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Hans AHNLUND Full name of sole or first inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
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☒ Additional inventors are being named on separately numbered sheets attached hereto.

The undersigned hereby authorizes the U.S. firm of **Ware, Fressola, Van Der Sluys & Adolphson LLP** to accept and follow instructions from the English firm of **Page White & Farrer** as to any action to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. firm and the undersigned. In the event of a change in the persons from whom instructions may be taken, the U.S. firm will be so notified by the undersigned.

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Hans AHNLUND Full name of sole or first inventor (given name, middle initial. FAMILY NAME(S) IN UPPER CASE)	
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Alexander ESSER Full name of second inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
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Philip WESBY Full name of third inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
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Additional Joint Inventors

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Residence	Citizenship
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Full name of sixth inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	Date
Residence	Citizenship
Post Office Address.	

Full name of seventh inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	Date
Residence	Citizenship
Post Office Address:	

Full name of eighth inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	Date
Residence	Citizenship
Post Office Address:	

☐ Additional inventors are being named on separately numbered sheets attached hereto.